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REPORT ON THE ALPO LTP OBSERVING PROGRAM

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Greenbelt, Maryland 20771

Report on the ALPO LTP Observing Program

by

Winifred Sawtell Cameron

The formal program for observations of Lunar Transient Phenomena (LTP) for the Association of Lunar and Planetary Observers (ALPO) was first announced in the June 1972 issue of Strolling Astronomer. In this issue the suggested methods of observation were given, and the call for observers was made. The gratifying response elicited 32 observers (1/6 of whom are women) showing interest in observing for the program (alphabetically listed in Table 1). The response in observations, however, is somewhat disappointing as only some six observers have reported with any regularity in the 15 months the program has been operating. Three others (all from countries other than the U.S.) have sent in a few reports, usually of features other than those assigned to them. Each observer was assigned four LTP sites, one non-LTP comparison site, and one of Latham's Seismic Zones.

The main objectives for the program are: (1) to monitor LTP sites and non-LTP comparison sites for normal as well as abnormal aspects in a random night observing format; (2) to establish quantitative albedo scales for each feature for each sunlit day (to decrease or eliminate the waxing phase bias of historic observations); (3) to establish a quantitative seeing scale based on the behavior of a star's diffraction disk. The first step for the observer was to set up his own albedo scale by observing at full moon and to produce a gray scale based on Elger's gray scale, with either pencil shadings or exposed film or paper.

The goal of randomness required that sites be observed at all ages of the moon (scattered in time) both while the observed feature was sunlit and if possible while it was in darkness too. Each feature was

Table 1. LTP Program Observers

Observer	Location	Telescope(in.)	No. of Nights Obs.	No. of Features Obs.
S. Anthony	Warren, PA			
J. Bartlett*	Baltimore, MD	3R, 4L, 5L	10	10
I. Beck	Wadsworth, OH	6L		
J. Benton	Savannah, GA			
R. Borek	Lancaster, CA	6L		
G. Chevalier	Quebec, Canada			
F. Dachille*	Univ. Park, PA	10.5L		
L. da Silva	Curitiba, Brazil	13R	2	7
E. Davis	Youngsville, PA	2R		
K. Delano**	Taunton, MA	12L	(3)	(43)
R. Dezmelyk	Newton Square, PA		(1)	(1)
R. Engstrom	Warren, PA	4L		
J. Fontana	Peekskill, NY			
M. Fornarucci	Garfield, NJ	6L	(4)	(4)
B. Frank	Hopkins, MN	6L	23	75
J. Galgocy	Philadelphia, PA	2R	7	28
D. Gens	Youngsville, PA	2R		
D. Harrold*	Cleveland, OH			
R. Hill	Greensboro, NC	6L, 2R, 10L	10	23
M. Huddleston	Mesquite, TX			
P. Jean	Montreal, Canada	4R	3	15
Z. Kleinman	Harrisburg, PA			
T. Lynch	Pittsburgh, PA	6L	6	29
L. Maleske	Las Cruces, NM		1	1
B. McCellan	Canoga Park, CA			
G. Persson	Hvidovre, Denmark		4	16
R. Peterson	W. Palm Beach, FL	6L		
A. Porter	Narragansett, RI	6L	40	119
H. Stelzer	River Forest, IL			
T. Traub	Warren, PA	8L	3	11
M. Valentine	Clarendon, PA			
G. Vargo (& Assoc.)	Pittsburgh, PA	5R, 6L, 13R		
J. West	Bryan, TX	8L		
		TOTAL	117	382

*Part time observer
**Observer on another program reports phenomena and sometimes normal aspects to me.
( ) Prior to June 1972

R = Refractor
L = Reflector

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to be observed at least twice, with observations at least 10 minutes apart. In order to produce albedo tables, every time a feature was observed, each point was to be monitored and its albedo estimated using the established gray scale. Several points in the crater were to be chosen with one on the nearby north or south plain as a comparison point. North or south was desirable in order to maintain the same relationship to the terminator as the feature. Ideally, several sets of albedo estimates for each sunlit day of a lunation would be obtained over a long period. Eventually, albedo charts even for each few degrees of colongitude might be produced. Bartlett for Aristarchus (1967), Proclus (private communication) and Vaucher (1973) for Alphonsus have reported albedos in such a manner. To date, only one feature (viz, Dawes) approaches the ideal of measures for each day of age; therefore, it will be the one that I will most fully analyze here.

Procedures to produce a seeing scale were described in the June 1972 issue of Strolling Astronomer (W. Cameron, 1972). It should be emphasized here, though, that in order to produce a standard quantification of seeing conditions the observer always should rack the eyepiece the same amount; e.g., one complete turn, and in the same direction, e.g., clockwise; and estimate the amounts of the two motions of that diffraction disk: (a) amount of expansion, and (b) amount of excursion of the image, in terms of fractions of the field of view (FOV) of his telescope. A more accurate method of determining the size of the expanded (and smallest) disk would be to time first the interval between successive drifting disappearances of the east and west edges of the disk (set at the edge of the FOV) of the field of view, and then the interval of time it takes the image to drift across the whole field of view. The intervals of time between successive blow-ups to the largest disk should also be timed. The amount of expansion gives an estimate of the amplitude of the wave that causes blurring (Baker, 1950), and the interval between expansions gives an estimate of the wavelength. The excursion motions, in turn, give estimates of the other type of "seeing" aberration -- scintillation. One type originates from turbulence a few feet above the ground and the other from turbulence at a higher altitude.

In the period June 1972 through August 1973 a total of 117 observing nights were reported. A few more were reported prior to June 1972. Among these 117 nights (75 with albedo measures) were 13 lunar transient phenomena (Table 2). Five of the 13 were reported on nights when other negative observations were reported and eight were of phenomena only. With relatively few observers reporting, there were no coincidences of dates, times, and features in the observations. The nearest coincidence in time was 14 hours, but observations were of different features.

Of the thirteen nights of positive reports, five were of non-LTP sites. Three sites had two reports each: Aristarchus, Lyell (or near it), and Calippus (or near it). I consider eight of the thirteen positive reports as probably true phenomena (one of which was given as a non-LTP, but I rated it similar to other LTP reports and listed it as one). There are other cases (e.g., Dawes) where LTP were not reported, or rather, reported as normal, but in which the albedos indicate anomalies. In most cases, however, there are still not enough observations for the same age to establish the normal albedo for that age. In one LTP report, the observer noted a brightening of three of his points (but two remained steady). In this case (Dawes), however, other nights of reported albedos at the same age suggest that this observer witnessed the ending of a dimming phenomenon and the return to normal. Such changes can be confirmed when we have the average of several albedo measures for a given age (or small range of colongitudes) for each feature. The outlook seems promising, and the efforts of these observers will establish for the first time a quantitative basis for comparison and detection of real lunar anomalies.

Table 2. LTP Reports

No.	Date Mo Day Year	U.T. Time	Feature	λ deg	β deg	Description	Obs.	g_d†	Days from F.M.	Col. deg	Dist from Term deg	Age d	Solar Effects K_p ΣK_p (max)	Location and Telescope	Albedo LTP	Albedo Normal	Albedo Plain	Seeing Exp‡ Sm Lg Time	Exc* Dist Time
1	2/23/72**	0010-0035	Piton	1W	41N	Usual visual shadow W. of Piton absent	Fornarucci	0.188	-6.1	12	11(R)[1]	8.0		Garfield, NJ 6L,250X	5	4.5	5	S=F T=3.5	
2	7/26/72	2140-2205	Aristarchus	47W	23N	Two brilliant pts. right more brilliant than left (obs. says no LTP)	da Silva	0.711	+0.6	102	55(R) or 125(S)[2]	16.1	4+;25	Rio, Brasil 13R,224X	10?	9?	7?	S=G T=F	
3	11/10/72	2342	Lyell	41E	14N	Dull grayish white spot 4" like a c.p.	Bartlett	0.649	-10.0	329	103(R)	4.9	2-;9-	Balt., MD 3R,54-200X	4		2?	S=3 T=5	
4	12/11/72*	2035 2030-2142	Alfraganus	17E	6S	Red color on limb E. equator area (chrom. aber.?)	Jean	0.730	-8.6	344	1(R)	6.0	S.C.-1 2-;6-	Montreal, Can. 4R,250X	3	3?	3	S=V.G.	
5	12/14/72*	2210	Proclus	46E	16N	Reddish-yellow at crater (chrom. aber?) no variations	Jean	0.836	-..5	21	67(R)	9.1	S.C.+1 3;17-	Montreal, Can. 4R,250X	2 (above normal?) 10?	8?		S=G	
6	1/25/73	1015	(Calippus α?) S. of Calippus	10E	37N	Bright spot (peak?) in dark part nr. term.	Frank	0.308	+6.5	172	-2(S)	20.8	5;26+	Hopkins, MN 6L,190X	8.5	0	8	1/20 4^s	1/15 ~5
7	2/12/73 to 2/13/73	2230-0130	Dawes	26E	17N	Brightening of some but not all his points (really caught end of dimming)?	Porter	0.982	-4.4	31	57(R)	9.6	M.S. 3,3-, 17,7	Narragansett, RI 6L,96.5X	5-3	6.5	3.2	1/70 S=V.G. T=0-4 1/45 3^s	1.30
8	2/13/73	2346	Calippus	10E	38N	Dark patch & over east of crater-never seen before or since	Frank	0.020	-3.4	44	54(R)	10.6	M.S. 3-;7	Hopkins, MN 6L,190X	3.5:	4.5	4.5	1/20 1/15 6^s	1/20 9^s
9	5/ 6/73	0448	Reiner	56W	7N	Slow brightening then blue-white flash, slow decrease 15-20^s	Bell	0.070	-11.0	313	105(R)	3.3	S.C. 4+;18	Lodi, CA 8.5L,142X	>4 mag above normal	3?	3?		
10	6/ 6/73	0240-0330	NE M. Tranq. (nr. Lyell?)	42:E	13:N	Obscuration on see	Jean	0.158	-9.7	331	13(R)	4.9		Montreal, Can. 4R,250X	(below normal?)	1.5?	1.5?	S=V.G. T=3	
			Peirce	53E	17N	Peirce obscured in red & blue filter		0.158	-9.7	331	24(R)	4.9			(below normal?)	2.5?	2.5?		
			Piccolomini	32E	30S	red on crater (chrom. aberr?)		0.158	-9.7	331	3(R)	4.9							
11	6/15/73	0621	Aristarchus	47W	23N	Pinkish red glow on E. wall (where usually sees violet)	Bartlett	0.482	-0.6	83	36(R)	14.1	S.C.-2	Balt., MD 3R,54-200X	8?	5?	7?	S=3 T=3	
12	7/14/73	0215-0305	Godin	10E	2N	Albedo changes of some points yellow on rim; atm?	Porter	0.490	-1.4	75	85(R)	13.6		Narragansett, RI 6L,96X	6.9	6.9	6	S=F	
13	7/18/73	0330-0345	Lalande	8W	5S	Star-like pt. variations 1-2S seen only at 40X	Galgocy	0.643	+2.6	124	64(S)	17.6		Wash., NJ 2R,40,64X	10?	8?	6?	S=V.G.	
14	7/26/72•	0800	Limbs			Two beams from limb regions down to earth	Benton, Mrs. Benton	0.710	0.0	90	180(R) 0(R)	15.5	4+;25	Balt., MD naked eye				S=E	

*Apollo 17 watch.
**Date is prior to LTP program, but reported by a participant.
•Unusual visual naked-eye observation.
†g_d = phase of anomalistic period

[1]R = rising terminator
[2]S = setting terminator
‡Exp = expansion of star's disk
*Exc = excursion of star's disk

The estimates for "seeing" conditions are establishing a quantitative base for this usually arbitrary and subjective estimate. Some of the results have been surprising. Judging from the reported star disk motions, I would have expected the estimates of very good seeing to accompany small expansion disks and long time intervals between expansions and excursions. Instead, observers have reported seeing conditions as excellent when the disk behavior suggested turbulence! (See Table 3.) Again, it is too early to establish a table of disk motions with a related letter or numerical scale such as the Antoniadi scale of seeing. The time intervals between successive similar motions are very important, especially for comparison with variations of lunar phenomena. If the variations are synchronous with the star disk motions, it is probable that those variations are due to terrestrial atmospheric phenomena. On the other hand, if they differ in timing, the phenomena are likely to be truly lunar rather than terrestrial. The observers who have been reporting have shown that the objectives of the program can be obtained. It is urged that others who have expressed a desire to participate will indeed do so whenever possible.

For some of the analyses to follow, I will use the feature that has the most complete record, viz, Dawes. The observer of Dawes has been rewarded with catching a phenomenon in this feature, and, in fact, in another of his features (Godin). Thus he has seen two phenomena (possibly more) out of 40 nights of observing which represent 86 separate times and 430 point observations (of which 35 were involved in the phenomena)! I conclude that, based on his experience, one can expect to see a recognizable phenomenon with a frequency of less than once in 10 times of observing.

Table 3 lists all the observations for Dawes reported through August 31, 1973, with auxiliary data from which analyses were made. Table 4 is the albedo chart for this feature. One can see from Table 4 that only 2 days are lacking measures for the whole age cycle when

Table 3. Total Observations of Dawes (26°E, 17°N) Sunrise at 334° Coleng., Sunset at 154° Coleng.

				Points										
No	ϕ_d	Date	Time(UT)	A	Avg	B	Avg	C	Avg	D	Avg	E(nrby plain)	Avg	Col (deg)
1	0.915	10/21/72	0150-0300											74
2	0.000	11/22/72	0035-0230	8,8,8,8,8	8.0	3,4,4,4,4.5	3.9	3,3,3,3,3	3.0	4,4,4,4.5,4.5	4.2	3,3,4,2.5,3	3.1	103
3	0.761	01/9-10/73	2245,0015	5,4.5	4.8	6.5,6	6.25	3.4,4	3.7	4.5,4.5	4.5	2.5,2.5	2.5	337
4	0.796	01/10/73	2250,2320	2.5,2	2.25	4.5,5	4.75	5,4.5	4.75	2.5,3	2.75	2.5,2.5	2.5	350
5	0.832	01/11-12/73	2320-0030	4,3,3.5	3.5	6,5.5,5.5	5.7	6,5,6	5.7	3.5,3,3.5	3.3	2,2.5,2.5	2.3	3
6	0.973	01/15-16/73	2330,0015	5.5,6.5	6.0	5,5.5	5.25	5.5,6	5.75	4.5,5.5	5.0	2,2	2.0	51
7	0.009	01/16-17/73	2325,0100	5.5,5	5.25	5,5.5	5.25	6,6	6.0	6,6	6.0	3,3	3.0	63
8	0.045	01/18/73	0010,0200	5.5,5.5	5.5	6,6	6.0	6,6	6.0	7,7	7.0	2.5,2.5	2.5	76
9	0.196	01/22/73	0325,0350	3.5,3,5	3.5	4,4.5	4.25	4,4	4.0	8,8.5	8.25	3,3	3.0	126
10	0.874	02/10/73	0000-0215	5,4,4	4.3	5.5,6,5.5	5.7	6,5,5	5.3	4.5,4.5,4	4.3	3,3.5,3.5	3.3	355
11	0.982	02/12-13/73*	0030-2355*	4,6,6,6,5.5	5.5	6.5,6.5,6.5,6.5,6.5	6.5	4,6.5,6.5,5,6	5.6	4,6,5.5,6,6	5.5	3,3.5,3.5,3,3	3.2	32
12	0.185	02/18/73	0130-0215	6,5.5	5.75	5.5,5.5	5.5	6,6	6.0	7,7	7.0	2.5,2.5	2.5	93
13	0.226	02/19/73	0115,0150	6,5.5	5.75	5.5,5.5	5.5	6,6	6.0	7.5,7.5	7.5	2.5,2	2.25	105
14	0.266	02/20/73	0255,0340	6,5	5.5	4:,5.5	4.75:	3.5:,5.5	4.5:	8.5,8.5	8.5	2.5,2.5	2.5	118
15	0.988	03/9-10/73	2350,0035	5.5,5.5	5.5	5,5	5.0	7,7	7.0	5.5,5.5	5.5	3.5,3.5	3.5	336
16	0.138	03/13-14/73	2345,0150	6,6	6.0	6.5,6.5	6.5	6,6	6.0	4.5,4.5	4.5	3,3	3.0	25
17	0.135	04/9-10/73	2350-0125	3.5,3,3	3.4	6,6,6	6.0	4,3,3.5	3.5	5,4,4	4.3	3,2.5,2.5	2.7	354
18	0.313	04/14-15/73	2330,0005	7.5,7.5	7.5	8,8	8.0	7.5,7.5	7.5	8,8	8.0	2.5,2.5	2.5	55
19	0.261	06/09/73	0030,0100	4,5	4.5	6,6.5	6.25	5,5.5	5.25	4.5,4	4.25	3.5,3.5	3.5	6.5
20	0.444	06/14/73	0335,0400	6,6	6.0	6,6	6.0	6,6	6.0	6.5,6.5	6.5	3,3	3.0	69
21	0.212	07/06/73	0100-0200	2,2,2	2.0	6.5,6.5,6.5	6.5	2.5,2.5,2.5	2.5	5.5,5.5,5.5,	5.5	2.5,2.5,2.5	2.5	337
22	0.251	07/07/73	0110,0230	4,4	4.0	6,6	6.0	4,4	4.0	4.5,4.5	4.5	4.5,4.5	4.5	350
23	0.283	07/08/73	0030-0100	4.5,4	4.25	5.5:,6.5	6.0:	4,4	4.0	4.5,4	4.25	3,3.5	3.25	1
24	0.322	07/09/73	0100-0220	4,4,4	4.0	5.5,6,6	5.8	4,4,4	4.0	3.5,3.5,3.5	3.5	3,3,3	3.0	14
25	0.459	07/13/73†	0040,0110	6.5,6.5	6.5	6,6	6.0	6.5,6.5	6.5	6.5,6.5	6.5	3,3	3.0	62
26	0.498	07/14/73	0215,0250	6.5,6.5	6.5	6,6	6.0	6.5,6.5	6.5	7,7	7.0	2.5,2.5	2.5	75
27	0.534	07/15/73	0120,0150	6,6	6.0	5.5,5.5	5.5	6,6	6.0	6.5,6.5	6.5	2.5,2.5	2.5	86
28	0.608	07/17/73	0420-0515	5.5,5,6	5.5	4,5,5	4.7	5,5.5,5.5	5.3	7,7,7	7.0	3,3,3	3.0	113
29	0.675	07/19/73	0245,0315	6,6	6.0	5,5	5.0	5.5,5.5	5.5	8,8	8.0	2.5,2.5	2.5	136
30	0.275	08/05/73	0000-0030	3,3,3	3.0	6.5,6.5,6.5	6.5	3,3,3	3.0	3.5,3.5,3.5	3.5	2.5,2.5,2.5	2.5	343
31	0.311	08/06/73	0030-0125	4,4,4	4.0	6,6,6	6.0	5,5,5	5.0	4.5,4.5,4.5	4.5	3,3,3	3.0	355
32	0.346	08/07/73	0020-0115	4.5,4.5,4.5	4.5	6.5,6.5,6.5	6.5	4.5,4.5,4.5	4.5	5,5,5	5.0	2.5,2.5,2.5	2.5	8
33	0.386	08/08/73	0145,0240	5,5	5.0	6,6	6.0	5,5	5.0	5,5	5.0	4,4	4.0	21
34	0.636	08/15/73	0200,0310	6,6	6.0	5.5,5.5	5.5	6,6	6.0	7,7	7.0	2,2	2.0	106
35	0.707	08/17/73	0130-0230	6,6,6	6.0	5,5,5	5.0	4.5,4.5,4.5	4.5	7,7,7	7.0	3.5,3.5,3.5	3.5	130
36	0.743	08/18/73	0230-0330	6.5	6.5	6	6.0	6.5	6.5	8.5	8.5	2.5	2.5	143

*LTP reported in Dawes
†LTP reported in Godin

Table 3 (Cont.)

Dist from Term (deg)	Seeing: Exp Sm	Lg	T (Sec)	S/T	Exc FR	(Sec)	Age d	Days from F.M. d	Alt (deg)	Mo	Date of F.M. d	h	Mo	Perigee d	h, Mo	d	h	Mo	Apogee d	h	Solar Effects K_p ΣK_p (max)	No.
100(R)				9/4			13.8	-1.4	65	O	22	13.5	S	25	07, O	23	12	O	11	03	4-,24-	1
51(S)	1/45				1/25		15.9	+1.0	26-45	N	20	23	N	21	00, D	19	13	D	04	14	5-,20	2
3(R)	1/40	1/25	4	7/4	1/20	5	5.2	-8.9	44-40	Ja	18	21.5	D	19	13, Ja	16	21	D	31	22	4+,5,25+,32	3
16(R)	1/35	1/20	3	6/4.5	1/15	4	6.2	-8.0	48-47	Ja	18	21.5	D	19	13, Ja	16	21	D	31	22	5,32	4
29(R)	1/50	1/25	3	7/4.5	1/20	5	7.3	-6.9	57-50	Ja	18	21.5	D	19	13, Ja	16	21	D	31	22	5-,5,30,30	5
77(R)	1/130	1/65	2	8/3	1/30	5	11.3	-3.9	60-65	Ja	18	21.5	D	19	13, Ja	16	21	D	31	22	3,3,17+,15+	6
89(R)				7/3			12.3	-2.9	45-59	Ja	18	21.5	Ja	16	21, F	13	11	Ja	28	16	3,2+,15+,11+	7
102(S)	1/50	1/35	2	6/3	1/25	4	13.3	-0.8	38-57	Ja	18	21.5	Ja	16	21, F	13	11	Ja	28	16	4+	8
28(S)	1/60	1/30	1	5/4	1/25	5	17.4	+3.3	20-30	Ja	18	21.5	Ja	16	21, F	13	11	Ja	28	16	2+,11+	9
21(R)	1/60	1/40	3	5/4	1/40	4	6.6	-7.4	75-36	F	17	10	Ja	16	21, F	13	11	Ja	28	16	4-,19+	10
58(R)	1/70	1/45	2	VG/0-4	1/30	3	9.6	-4.4	55-73	F	17	10	Ja	16	21, F	13	1	Ja	28	16	3,3-,17,7	11
61(R)	1/60	1/30	3	8/4	1/30	4	14.7	+0.7	29-35	F	17	10	F	13	11, Mr	10	08	F	25	13	4-,20-	12
119(S) 49(S)	1/60	1/45	2	5/4	1/40	4	15.7	+1.7	15-20	F	17	10	F	13	11, Mr	10	08	F	25	13	3+,SC-2,18+	13
36(S)	1/70	1/45	2	6/4	1/30	3	16.8	+2.7	20-30	F	17	10	F	13	11, Mr	10	08	F	25	13	4,SC-1,15	14
2(R)	1/70	1/55	3	6/4	1/25	5	5.0	-9.0	50-40	Mr	18	23.5	F	13	11, Mr	10	08	F	25	13	3+,3,20-,16-	15
51(R)	1/100	1/75	4	4/3.5	1/40	6	9.0	-5.0	70-65	Mr	18	23.5	Mr	10	08, Ap	06	04	Mr	25	09	2+,2-,11,7+	16
20(R)	1/110	1/55	3	8/3	1/30	2	6.5	-7.5	70	Ap	17	14	Ap	06	04, My	04	06	Ap	22	02	3+,1+,12,7-	17
81(R)	1/75	1/30	3	8/0-3	1/30	5	11.5	-2.5	30-40	Ap	17	14	Ap	06	04, My	04	06	Ap	22	02		18
32.5(R)	1/60	1/40	1	9/0	1/50	2	7.8	-6.8	40	Je	15	20.5	Je	01	14, Je	30	00	Je	15	17		19
95(R)	1/105	1/70	3	5/4	1/70	4	13.0	-1.6	25	Je	15	20.5	Je	01	14, Je	30	00	Je	15	17		20
3(R)	1/85	1/65	3	4/4	1/50	3	5.6	-9.4	20-15	Jy	15	11	Je	30	00, Jy	28	07	Jy	12	22		21
16(R)	1/60	1/40	3	7/1-5	1/20	4	6.6	-8.4	20-12	Jy	15	11	Je	30	00, Jy	28	07	Jy	12	22		22
27(R)				6/0			7.5	-7.5	20-18	Jy	15	11	Je	30	00, Jy	28	07	Jy	12	22		23
60(R)	1/75	1/50	4	3/0-4	1/25	2	8.6	-6.4	20-15	Jy	15	11	Je	30	00, Jy	28	07	Jy	12	22		24
88(R)	1/80	1/40	2	3/0-2	1/30	1	12.5	-2.5	15-16	Jy	15	11	Je	30	00, Jy	28	07	Jy	12	22		25
101(R)	1/60	1/45	2	3/2	1/20	3	13.6	-1.5	20-22	Jy	15	11	Je	30	00, Jy	28	07	Jy	12	22		26
112(R)	1/75	1/50	3	4/1	1/30	2	14.6	-0.4	14-16	Jy	15	11	Je	30	00, Jy	28	07	Jy	12	22		27
41(S)	1/120	1/80	6	4/1	1/60	3	16.7	+1.7	25-30	Jy	15	11	Je	30	00, Jy	28	07	Jy	12	22		28
18(S)	1/90	1/60	4	3/5	1/50	5	18.6	+3.6	10-16	Jy	15	11	Je	30	00, Jy	28	07	Jy	12	22		29
9(R)				7/0			6.2	-9.1	15-10	Au	14	02	Jy	28	07, Au	25	07	Au	09	10		30
21(R)	1/105	1/70	3	5-6/1	1/50	5	7.2	-8.1	15-10	Au	14	02	Jy	28	07, Au	25	07	Au	09	10		31
34(R)	1/80	1/60	3	5/0-3	1/40	4	8.2	-7.1	[illegible]-10	Au	14	02	Jy	28	07, Au	25	07	Au	09	10		32
47(R)	1/75	1/55	4	8/3	1/20	3	9.3	-6.0	10-7	Au	14	02	Jy	28	07, Au	25	07	Au	09	10		33
48(S)	1/80	1/55	3	6/3	1/30	4	16.3	+1.0	25-35	Au	14	02	Jy	28	07, Au	25	07	Au	09	10		34
24(S)	1/80	1/60	2		1/30	3	18.2	+3.0	5-15	Au	14	02	Jy	28	07, Au	25	07	Au	09	10		35
11(S)	1/80	1/40	2	4/2	1/20	4	19.2	+4.0	15	Au	14	02	Jy	28	07, Au	25	07	Au	09	10		36

Table 4. Dawes Albedo Chart

A. Porter
Narragansett, R. I.
6L, {100X
{195X

A
D ⊕ B S ↓
C
E

Sunrise Colong. = 334° ≅ 5d
Sunset Colong. = 154° ≅ 21d

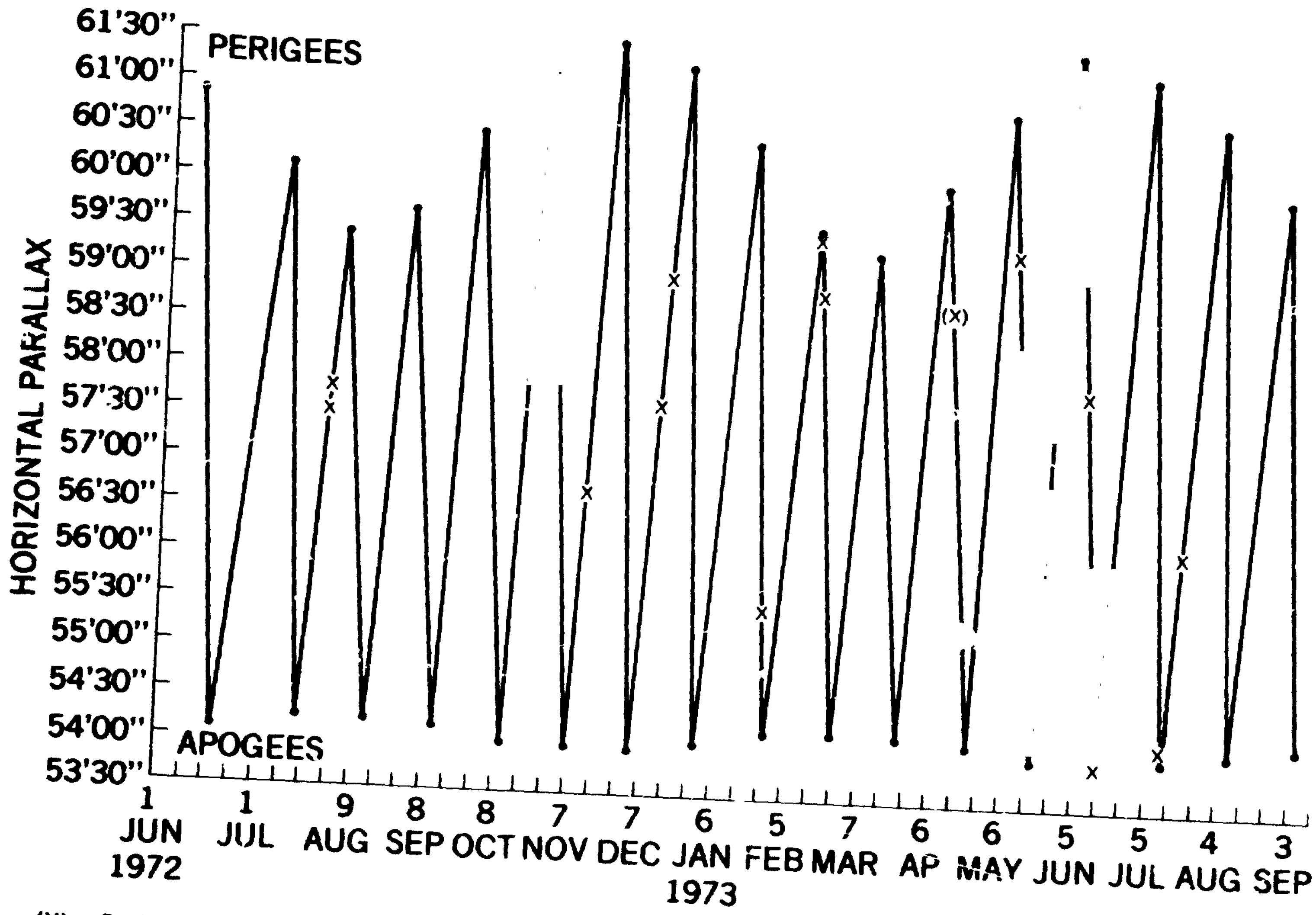
AGE	POINT A	POINT B	POINT C	POINT D	(NEARBY POINT E PLAIN)
0d-0.9d					
1.0-1.9			D A R K S I D E		
2.0-2.9					
3.0-3.9					
4.0-4.9			S U N R I S E		
5.0-5.9	5,4,5; 2,2,2; 5.5,5.5	6.5,6; 6.5,6.5,6.5; 5,5	3.4,4; 2.5,2.5,2.5; 7,7;	4.5,4.5; 5.5,5.5,5.5,5.5,5.5,	2.5,2.5; 2.5,2.5,2.5; 3.5,3.5;
6.0-6.9	2.5,2; 3.5,3,3; 3,3,3;	4.5,5; 6,6,6; 5.5,6,5.5;	5,4.5; 4,3,3.5; 6,5,5;	2.5,3; 5,4,4; 4.5,	2.5,2.5; 3,2.5,2.5; 3,3.5,3.5;
	5,4,4; 4,4;	6,6; 6.5,6.5,6.5;	4,4; 3,3,3;	4.5,4; 4.5,4.5; 3.5,	2.5,2.5,2.5; 4.5,4.5;
				3.5,3.5;	
7.0-7.9	4,3,3.5; 4,4,4; 4,5;	6.5.5,5.5; 5,5,5; 6,6.5;	6,5,6; 4.5,4.5,4.5; 5,5.5;	3.5,3,3.5; 4.5,4; 4.5,4;	2,2.5,2.5; 3.5,3.5; 3,3.5;
	4.5,4; 6,6,6;	5.5:, 6.5;	4,4; 3,3,3;		
8.0-8.9	4,4,4; 4.5,4.5,4.5;	5.5,6,6; 6.5,6.5,6.5;	4,4,4; 4.5,4.5,4.5;	3.5,3.5,3.5; 5,5,5;	3,3,3; 2.5,2.5,2.5;
9.0-9.9	4,6,6,6,5.5*; 6,6; 5,5;	6.5,6.5,6.5,6.5,6.5*;	4,6.5,6.5,5,6*; 6,6; 5,5;	4,6,5.5,6,6*; 4.5,4.5;	3,3.5,3.5,3,3*; 3,3; 4.4;
		6.5,6.5; 6,6;		5,5;	
10.0-10.9					
11.0-11.9	5.5,6.5; 7.5,7.5;	5,5.5; 8,8;	5.5,6; 7.5,7.5;	4.5,5.5; 8.8;	2,2;2.5,2.5;
12.0-12.9	5.5,5; 6.5,6.5;	5,5.5; 6,6;	6,6; 6.5,6.5;	6,6; 6.5,6.5;	3,3; 3,3;
13.0-13.9	5.5,5.5; 6,6; 6.5,6.5;	6,6; 6,6; 6,6;	6,6; 6,6; 6.5,6.5;	7,7; 6.5,6.5; 7,7;	2.5,2.5; 3,3; 2.5,2.5;
14.0-14.9	6,5.5; 6.5,6.5,6.5; 6,6;	5.5,5.5; 6,6,6; 5.5,5.5;	6.6; 6.5,6.5,6.5; 6,6;	7,7; 7.5,7.5,7.5; 6.5,	2.5,2.5; 3,3,3; 2.5,2.5;
				6.5;	
15.0-15.9	8,8,8,8,8; 6,5.5;	3,4,4,4,4.5; 5.5,5.5;	3,3,3,3,3; 6,6;	4,4,4,4.5,4.5; 7.5,7.5;	3,3,4,2.5,3,2.5,2;
16.0-16.9	6,5; 6,6; 5.5,5,6;	4:,[illegible].5; 4,5,5; 5.5,5.5;	3.5:, 5.5; 5,5.5,5.5; 6,6;	8.5,8.5; 7,7,7; 7,7;	2.5,2.5; 3,3,3; 2,2;
17.0-17.9	3.5,3.5;	4,4.5;	4,4;	8,8.5;	3,3;
18.0-18.9	6,6; 6,6,6;	5,5; 5,5,5;	5.5,5.5; 4.5,4.5,4.5;	8,8; 7,7,7;	2.5,2.5; 3.5,3.5,3.5;
19.0-19.9	6.5;	6;	6.5;	8.5;	2.5;
20.0-20.9					
21.0-21.9			S U N S E T		
22.0-22.9					
23.0-23.9					
24.0-24.9					
25.0-25.9					
26.0-26.9			D A R K S I D E		
27.0-27.9					
28.0-28.9					
29.0-29.5					

:uncertain measures ;Separation of measures of different nights
*LTP Reported (for points A, C, D) ,Separation of individual measures in one night

the feature is sunlit. The sunrise and sunset lines are averages for these ages as they can shift by 1 1/2 days either way, depending on the shape of the lunar orbit, which changes its ellipticity in a 14-month cycle. (See Figure 1.) Note the LTP observations compared with estimates for other dates at age 9 days in Table 4. (There are three nights of observations for this age.) For the LTP estimates (five for each point) the first estimate was four (for point A), the next a few minutes later was six, and following estimates remained higher. Similarly for points C and D the first estimate was low and the later ones were higher. Note also that point B and point E (the nearby plain comparison point) did not change. Note also that the measures for other dates are the higher ones, except for point D. This is the basis for my suspicion that the observer actually saw the end of a dimming phenomenon and the return to normal.

I have analyzed the observations for several hypotheses similar to my previous analyses in several papers (W. Cameron and Gilheany, 1967; W. Cameron, 1967; W. Cameron, 1971; and W. Cameron, 1972). Figure 2 shows two panels, the panel on the right giving the anomalistic phase histograms (tidal effect hypothesis) for Dawes (Porter's observations), for all observations (mostly normal) received through August 1973 which contained albedo measures (75 nights), and for the LTP phenomena. The other panel on the left shows histograms of the same observations with respect to the moon's age.

The first to be discussed is the tidal hypothesis. For the tidal hypothesis (anomalistic phase $\emptyset_d$) $\emptyset_d = \dfrac{d - P_1}{P}$ (P_2 = following perigee date, P_1 = preceding perigee date surrounding the date of observation (d), and $P = P_2 - P_1$ in days). Perigee and apogee are indicated by vertical lines labeled P and A. Examining the anomalistic phase histograms, one notes that there are two peaks for the normal aspects reports and for Dawes -- the higher one at $\emptyset_d = 0.3$ and the other at $\emptyset_d = 0.0(1.0)$, i.e., perigee. The first three points are repeated at the right edge, labeled



(X) 2/23/72 PLOTTED TO SHOW RELATIONSHIP TO REPEATABLE ANOMALISTIC ORBIT

Figure 1. Reported LTP observations plotted on the anomalistic orbit of the moon to show tidal relationship with respect to Green's hypothesis (1965)

REPEAT. If observations were evenly distributed, the bars would all be equal in height (indicated by the horizontal line labeled RANDOM); therefore, the observations were not random or evenly distributed with respect to the anomalistic period. The positive (LTP) reports histogram has three peaks and therefore has no correlation in the tidal hypothesis. Little reliance can be placed on these results as in all cases we are dealing with small samples, especially for the positive LTP reports. The number of nights of observation are 75 for the negative, 36 for Dawes (Table 3) and 13 for LTP (Table 2). In Table 2, the columns are mostly self-explanatory (see footnotes). Column 9 is "days from full moon," minus indicating before and plus after full moon. Column 13 contains solar data giving max. K_p index ($K_{p_{max}}$) for that day, the sum of K_p for that day (ΣK_p), and indication of a magnetic storm where S.C. = sudden commencement and M.S. = magnetic storm. The last column (Seeing) gives smallest diffraction disk diam (Sm) in terms of fractions of field of view, largest disk diam (Lg) and interval in seconds for expansion, amount of excursion (Fr) of image in fractions of FOV, and interval between excursions in seconds. It also rates the seeing (S) on a numerical scale and transparency (T) in magnitudes visible. In Figure 1 the relationship of the observations with the shape variations of the orbit is shown where, in Green's hypothesis (1965), maximum degassing (LTP) would occur at eccentric apogees (Apr. to June, Oct. - Dec. 1972, and May to July 1973) and minimum degassing (few or no LTP) at minimally eccentric perigees (Aug. - Sept. 1973). We get two observations at the right apogee time but also one at the wrong perigee time, and all the rest fall at the in-between times with no tidal correlation.

The age panel (Figure 2) has vertical lines indicating the approximate ages that the moon enters and exits the bow-shock front (BSF) and magnetopause (MP) of the earth's magnetic tail and the approximate sunrise and sunset ages for Dawes. Two variations of the second hypothesis (Speiser, 1965, 1967; A. Cameron, 1964) suggest energetic effects of

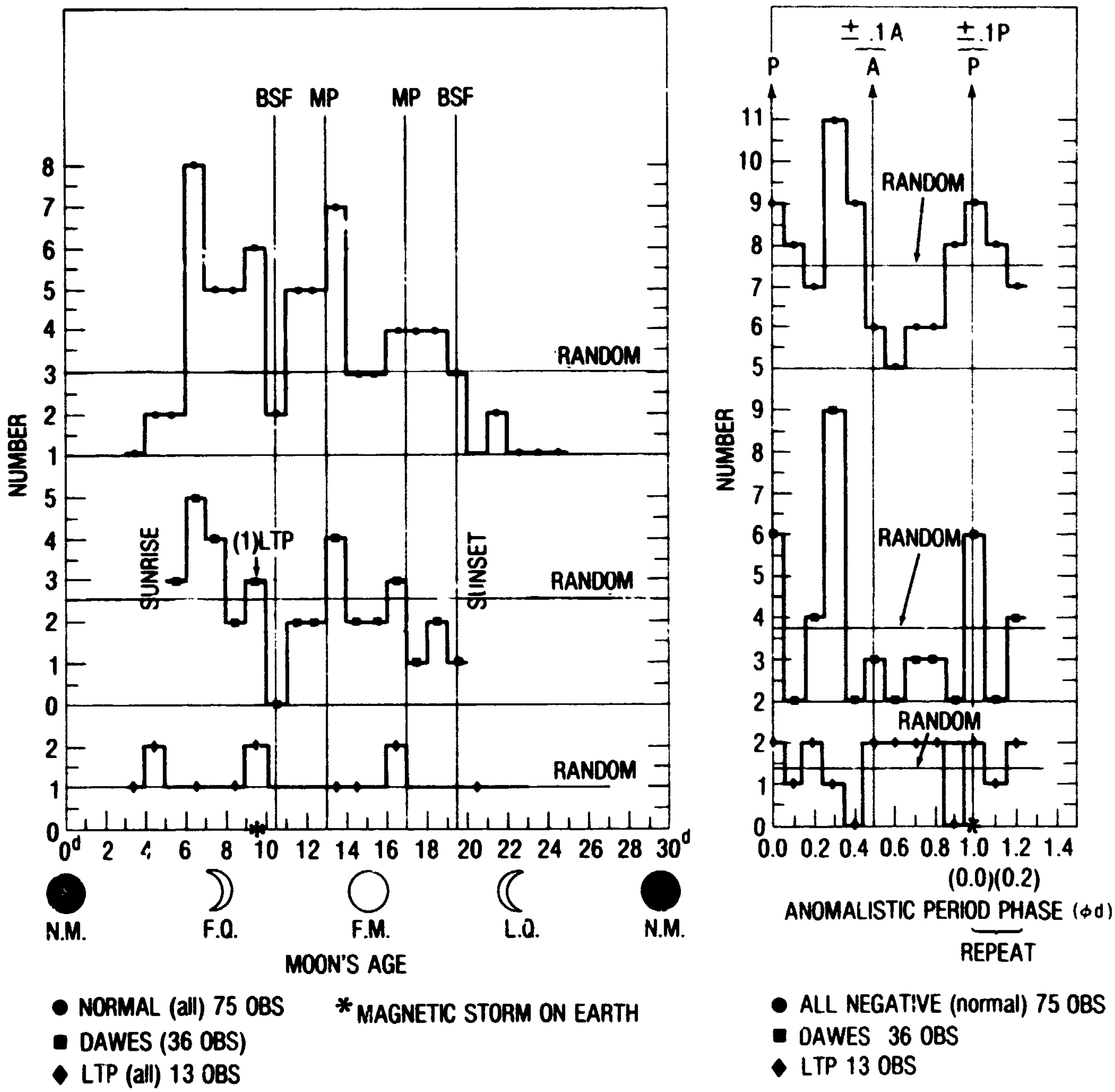


Figure 2. Histograms of the Normal Aspects, Dawes, and LTP Observations with respect to the Moon's Age (left panel) and the phase of the anomalistic period (right panel). Vertical lines indicate approximate locations of the boundaries of the bow shock front (BSF), magnetopause (MP) of the earth's magnetic tail, perigee (P), and apogee (A). Phases are indicated symbolically at the bottom. The horizontal lines marked RANDOM indicate the number of observations per unit if the observations were distributed at random (evenly).

the magnetic tail on solar particles which are focused on the moon and excite surface materials or escaped gases. Low-angle illumination effects would be expected near sunrise and sunset. The one LTP in Dawes has no sunrise or magnetic tail correlation. It does have perigee and solar particles correlations. There are several peaks for the LTP group, one of which occurs within the magnetopause, indicating a possible correlation with magnetic tail effects. The fourth hypothesis considered is the direct influence of solar plasma (Kopal, 1966) as correlated with simultaneous (or nearly simultaneous) terrestrial magnetic storms (when energetic solar plasma is bombarding both the earth and moon nearly simultaneously). In this respect, the Dawes LTP occurred not only at perigee, but also when energetic solar flare plasmas were striking the moon and earth, as a magnetic storm was in progress on the earth. Since only Dawes and Calippus, 22 hr later, were reported as anomalies (although the whole moon was not being monitored), surface characteristics at these places must be studied to determine, if there is a solar particles effect, why some places respond to particles and others do not. There are, however, correlations of LTP in general (W. Cameron, 1972) with the earth's magnetic tail and for historic Proclus data with direct solar particles, which are still maintained in the recent data (see Table 5). There were six sudden commencements of magnetic storms from October 1972 through April 1973, and possibly three more magnetic storms without sudden commencements.

If LTP actually occurred randomly, one could estimate what percentage of observations would be expected to occur within arbitrarily prescribed limits for each of the competing hypotheses. Under the tidal hypothesis, for example, if the observations were considered in increments of one-tenth of an anomalistic period (perigee to perigee), then observations falling within one-tenth of a period of perigee would constitute a correlation. On this basis, plus or minus one-tenth of a period equals 20 percent. One would expect then, if they occurred at random, that 20 percent of the observations would occur $\leq \pm 0.1P$, with the same

Table 5. Comparisons of Observations with Hypotheses

EFFECT	LIMITS	ALL NEGATIVE No. exp.	% exp.	No. obs.	% obs.	O/E	DAWES No. exp.	% exp.	No. obs.	% obs.	O/E	LTP No. exp.	% exp.	No. obs.	% obs.	O/E
TIDAL	≤±0.05P	7.5/75	10	9/75	12	1.2	4/36	10	6*/36	18	1.8	1/13	10	2/13	15	1.5
	≤±0.05A	7.5/75	10	6/75	8	0.8	4/36	10	3/36	8	0.8	1/13	10	2/13	15	1.5
	≤±0.1P	15/75	20	15/75	20	1.0	7/36	20	7/36	19	1.0	3/13	20	3/13	23	1.1
	≤±0.1A	15/75	20	10/75	13	0.65	7/36	20	4/36	11	0.55	3/13	20	2/13	15	0.75
	≤±0.05P&A	15/75	20	15/75	20	1.0	7/36	20	9/36	25	1.25	3/13	20	4/13	31	1.5
	≤±0.1P&A	30/75	40	25/75	33	0.8	14/36	40	11/36	31	0.8	5/13	40	5/13	38	1.0
LOW ANGLE ILLUM	≤+1^{d}S.R.	3/75	4				1/36	4	5/36	14	3.5	0.5/13	4	3/13	23	5.75
	≤-1^{d}S.S.	3/75	4				1/36	4	1/36	3	0.75	0.5/13	4	1/13	8	2.0
	≤+2^{d}S.R.	6/75	8	N/A			3/36	8	9/36	25	3.1	1/13	8	5/13	38	4.75
	≤-2^{d}S.S.	6/75	8				3/36	8	3/36	8	1.0	1/13	8	1/13	8	1.0
	≤±1^{d}S.R. &S.S.	12/75	16				6/36	16	6/36	17	1.1	2/13	16	4/13	31	1.9
	≤±2^{d}S.R. &S.S.	23/75	31				11/36	31	12/36	33	1.1	4/13	31	6/13	$\boxed{46}$	1.5
MAG TL	≤±2^{d}f.m. (m.p.)	12/75	16	16/75	21	1.3	6/36	16	10/36	28	1.75	2/13	16	3/13	23	1.4
	≤±1^{d}BSF(2)	12/75	16	7/75	9	0.6	6/36	16	4/36	11	0.7	2/13	16	1/13	8	0.5
SOLAR EFFECTS	≤±0^d.5ms	2/48	4	2/75	4	1.0	0.7/17	4	1/17	6	1.5	0.4/11	4	3/11	27	6.75
	≤±1^{d}ms	4/48	8	4/75	8	1.0	1/17	8	2/17	12	1.5	1/11	8	5/11	$\boxed{45}$	5.6

* 1 of the 6 was a LTP, thus 1/36 = 3%
.05P = 1.4 days
0.1P = 2.8 days
P = 27.6 days

proportion for apogee. Thus 40 percent of observations should fall $\leq$ 0.1P and A. Similarly, sunrise and sunset correlations may be considered to be observations occurring within 1 day (12°) of sunrise and sunset. This is equivalent to 1 day in 25.5 days (considered to be a lunation period since the moon is seldom observed at ages $\leq 2^d$ or $\geq 27^d.5$) for sunrise or ~ four percent of the time (and another four percent for sunset); or if 2 days are considered the limit, then eight percent for sunrise and eight percent for sunset. For magnetic tail effects it might be $\leq \pm 1^d$ of BSF entrance = $\frac{2}{25.5}$ = ~ eight percent. In Table 5 all percents are to the nearest whole percent and all numbers for Number Expected (No. Exp.) are given to the nearest whole number. On these bases Table 5 gives the observed and expected percents for the various hypotheses, so that all hypotheses can be compared together. Since the columns for All Negative and for Dawes are for normal aspects of features (with one exception for Dawes), the figures for observed versus those for expected will indicate just how near to random the observations were (summarized in the column $\frac{O}{E}$ which is the ratio of the observed to the expected in percent). Thus the majority of negative observations were almost at random with respect to the tidal hypothesis (anomalistic period) -- slightly deficient near apogee. The observations of Dawes, however, were almost twice as frequent (over randomness) for times very near perigee, and half as frequent (as they would be if random) during the anomalistic period between 0.4 and 0.6 (near apogee). The one Dawes LTP came very near perigee ($\emptyset_d$ = 0.98). The LTP column is the column of greatest interest although the sample number (13) is too small to give significant results. One and one half as many were observed as would be expected if they occurred randomly for phases very close to perigee and apogee ($\leq \pm$ 0.05 P or A), but the LTP's fell to randomness when the limits were expanded ($\leq \pm$ 0.1 P or A). (See column $\frac{O}{E}$, i.e., if phenomena occurred near perigee or apogee, they occurred very near one or the other.)

For low-angle illumination (or sunrise) effects the observed quantities cannot easily be determined, as these represent nights when several features were observed. Each feature's results were not assessed for this table. (The number of observations would be about 200 instead of 75.) Therefore, the observed columns have been designated as not applicable (N/A). For Dawes we can see that the bias toward waxing phases is still present -- where 3.5 times as many observations were made near sunrise on Dawes as would be expected on a random basis while the observed number is less than expected near sunset, and five times as many were observed near sunrise as at sunset. One of the objectives of this program was to reduce this bias as it affects statistics for sunset effects. There are some professional observations of glows occurring near sunset (Anon. 1973). In my analyses of > 800 reports (W. Cameron 1972), the histograms showed a slight peak near sunset but the number of observations was only about 10! I would like to see if there really is a sunset effect; therefore, I need observations near feature sunset. Unfortunately, for the Western Hemisphere features, sunset occurs at the waning crescent stages when the moon does not rise till well after midnight. This necessitates early morning observations -- a difficult time for people who have other vocations -- a practically universal condition. Nevertheless, I make the plea that all observers make an effort to get observations for ages later than 22 days occasionally. Observers sometimes may be compensated by observing phenomena at those times.

For the magnetic tail hypotheses we see that for All Negative the number observed were at random since the $\frac{O}{E}$ ratio is near unity, with a similar result for solar flare effect. In the case of Dawes, there was a definite positive bias in the observations for near full moon (MP) and a negative bias for near the bow-shock front (BSF). The number of observations for solar effects is smaller because there was not the auxiliary information on magnetic storms available for the July and August 1973 observations. Thus the statistics have even less meaning. They indicate that more were observed than would be expected on a random basis.

If we look at the small sample of LTP observations, we find that almost six times as many phenomena were seen near sunrise as would be expected ($\frac{O}{E} = 5.75$) and twice as many near sunset. A slight excess was observed when the moon was within the magnetopause (MP) of the earth's magnetic tail, but there was a deficiency with respect to the BSF. The surprising statistic is the number of lunar events that occurred on the same day that a terrestrial magnetic storm occurred (signaling the arrival of energetic particles bombarding the surfaces of both planets). Almost seven times as many events were observed as would be expected on a random basis. This is the largest ratio; hence it was circled as showing the greatest effect among the hypotheses. When percentage of observations is considered, we find that 46 percent of all LTP occurred near sunrise or sunset, and 45 percent occurred when a lunar event occurred within 1 day of a sudden commencement of a terrestrial magnetic storm (arrival of plasmas in the earth-moon system). This limit of 1 day means that the arrival of plasmas at the moon was up to 1 day sooner or 1 day later than the day of the commencement of the magnetic storm at the earth. This limit is probably too generous, as the arrival times ought to be nearly simultaneous, or at most, separated by a few hours. Note, however, that only 15 percent (about 1/7) occurred near either perigee or apogee -- which is far from the majority of cases, or even all of them, occurring at those times that are frequently quoted in the literature usually without actual statistics. In contrast to the 15 percent near perigee or apogee (31 percent for both tidal effects), 23 percent (about 1/4) occurred within 1 day of sunrise, 31 percent within 1 day of sunrise or sunset combined (same percentages as the tidal effects), and 23 percent (1/4) occurred while the moon was in the magnetopause. The largest individual percentage (27 percent or > 1/4) occurred on the same day that a magnetic storm occurred on earth. These statistics imply stronger cases for the other hypotheses than for the tidal one. Note also that the LTP tidal histogram shows no correlations since it has three peaks, one of which extends over 0.3 of a period.

Let us now examine the observations for albedo behavior. Mr. Vaucher (1973) reported on observations of Alphonsus and showed curves of albedos vs colongitude in 10° increments for several points in Alphonsus. He noted that there were peaks for bright areas and valleys for dark areas in the albedo generally near certain colongitudes, viz, 60°, 100°, and 140°. In Figure 3 the albedo histograms are given for several points in three features: Dawes, Proclus, and Alphonsus. The Dawes observations are from the ALPO-LTP program from observer Alain Porter, Narragansett, Rhode Island, with a 6-inch reflector at about 100 magnification. The Proclus observations (covering about 20 years) are from a private communication from James Bartlett, Baltimore, Maryland, who used a 3-inch refractor, 4-inch refractor, 4-inch reflector, and a 5-inch reflector at various powers from 50 - 300. The Alphonsus integrated light observations are taken from Vaucher (1973) and represented as histograms instead of curves. Histograms are appropriate because the albedos have been averaged in increments of 10 degrees of colongitude. Besides the various individual points plotted, we can choose some points between each feature that might be considered more comparable. For example, the floor of Proclus may be compared with the plain near Dawes and the dark spot on the floor of Alphonsus. To a first approximation, the three areas show similar behavior. The nearby plain at Dawes, however, behaves more similarly to the dark patch on the west central floor of Alphonsus than to the floor of Proclus. Comparisons can only be made over 130° of colongitude (from 4° to 134°). Sunrise and sunset for each feature, the phases, and the magnetic tail features (magnetopauses (MP) and bow-shock front (BSF)) are indicated on the graph. At 60° both Proclus

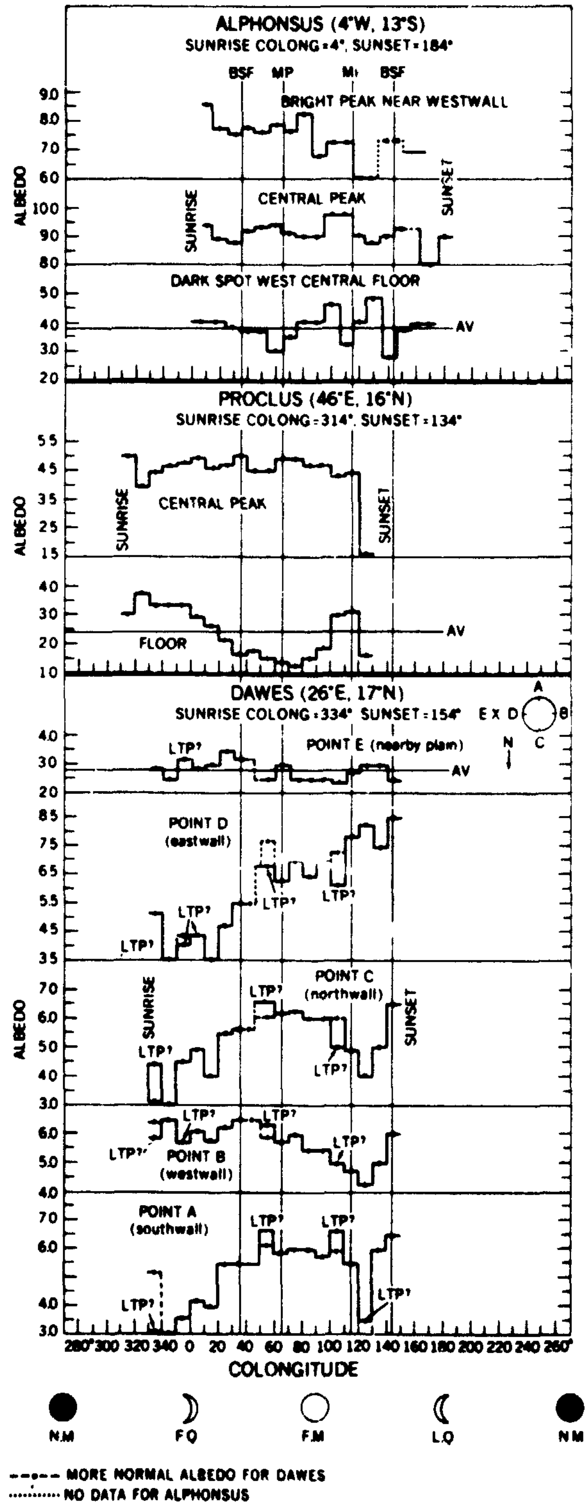


Figure 3. Albedo histograms of observations with respect to colongitude for specific points within Dawes, Proclus, and Alphonsus for comparison. Approximate locations of the bow-shock front, magnetopause of the earth's magnetic tail, sunrise and sunset for each feature, and the phases of the moon are indicated.

and Alphonsus have drops in albedo but Mare Tranquillitatis (just east (IAU) of Dawes) rises at 100°. Proclus and Alphonsus rise but Mare Tranquillitatis is down. At 140° both Alphonsus and Mare Tranquillitatis are down but Alphonsus rises and stays elevated till sunset. The Alphonsus floor is brighter near full moon (in the magnetopause) while M. Tranquillitatis and the floor of Proclus are darker, though Proclus rises in albedo as the moon is passing out of the magnetopause. The bow-shock front depresses the albedo. Averaging all the albedo measures for each feature (indicated by horizontal line marked AV), we obtain 2.8 for Mare Tranquillitatis, 2.5 for Proclus floor, and 3.8 for Alphonsus floor (dark patch). The apparent anomalous albedo behavior of Mare Tranquillitatis between 60° - 70 colongitude is real, for there are three nights with six individual measures in the average and all were estimated at 3.0. It occurs at the time that the moon enters the magnetopause of the earth's magnetic tail. From the measures submitted I suspect a possible LTP (albedo anomaly) in Mare Tranquillitatis at 350° colongitude. The observer did not report it as anomalous, even though the previous night he estimated the area at 2.5, and the night after it at 3.0 and 3.5 for an average of 3.25, while on this night (July 17, 1973) he twice estimated it at 4.5, which is the highest albedo recorded for it of all 36 nights. One other night (August 7, 1973) it was estimated twice at 4.0 at colongitude 21°. The suspicion of a real brightening (almost two whole albedo steps) is fairly well-founded as there are five nights of observations (with 13 individual measures), so that the average of 2.9 (without the anomalies) from four nights and 11 individual measures can be accepted with some confidence. This point is one of the darkest parts of the moon, being in that dark border between Mare Tranquillitatis and Mare Serenitatis. Comparing the bright areas of the three features, viz, the west wall point (B) of Dawes, a bright peak near the west wall of Alphonsus, and the central peak of Proclus (Figure 3), again, to a first approximation, all three areas behave similarly. In general, their behavior is almost opposite to that of the dark areas. Note also the mirror behavior between points A and C in the Dawes histograms (see sketch on Table 3 for locations of points in Dawes). Until full moon the central peak of Proclus and the west wall peak in Alphonsus behave similarly, and in the phases after full moon the west wall of Dawes and the central peak of Proclus behave similarly. There is a smaller variation in the Proclus central peak than in the other two features. Near 60° Proclus and Alphonsus peaks are up and the Dawes peak is down. At or near 100° Alphonsus is up but the other two are down, while at 140° both Dawes and Alphonsus are up considerably. Kepler (Delano, 1972) also confirms this 140° peak, somewhat less so for the 60°, but it has a valley at 100° (converting Delano's days to colongitude values). Thus the results for the other two comparable features supply both confirmation and contradiction for the results reported for Alphonsus. There are enough measures now that I can do similar analyses for a few other features. That will be done in a future report. The results indicate variations in behavior of the lunar surface in different regions of the moon.

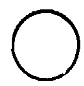
During the December 7-19, 1972, time period the last Apollo mission took place. I asked all observers to maintain a watch for a 2-week period surrounding the time the astronauts would be in the vicinity of the moon. The period was to be December 7 through December 21, and the observers were to observe every night that weather would permit. Unfortunately, the weather was uncommonly poor throughout the country. The majority of people who sent in reports reported they were clouded out for the mission. Of the 25 observers in the program at the time, only five were able to observe. Of these five, one, Mrs. Jean of Montreal, Canada, using a 4-inch refractor at 250X, reported two anomalies. On December 11 she noted reddish color at Alfraganus (a non-LTP site) and on December 14 reddish and yellow colors at Proclus (see Table 3). These colors might have been caused by chromatic aberration, a defect of refractors which requires great care to eliminate as a cause of colors on the moon. I am uncertain whether Mrs. Jean exercised the necessary precautions. Her assigned features are North Mare Crisium, Maskelyne, Ptolemaus, and Copernicus. The albedo measures I wanted my observers to make were not reported by her, and she observed many other features besides her assignments but did not make the albedo or seeing estimates. Similarly, I have received reports from other foreign observers about features other than those assigned to them, with no numerical albedo or seeing estimates. I present in Table 6 a sample monthly reporting form for non-LTP (normal aspect) reports. This form indicates the information I would like to receive monthly for the six assigned features (four LTP, one non-LTP comparison feature, and one seismic zone). I can supply these forms to observers.

In summary, the LTP program has been operating for about 15 months at the time of this writing. Although more than 30 observers expressed interest in joining the program and were assigned features (thus all 100 or so LTP features have been assigned), only about a half dozen people have sent in observations more or less regularly. In some cases, those that did send in reports did so on features other than those assigned to them, or in addition to their assignments. Out of 117 nights of observations, there were 13 on which phenomena were reported. Eight of these nights were reports of LTP only, and five were coincident with nights when other features had normal aspects. None of the LTP dates and times overlap, although two occurred within 22 hours of each other. On another date, one LTP and a peculiar phenomenon (listed at the bottom of Table 3) occurred within a 14-hour interval. In the albedo measures reported, there are several cases of suspected anomalies, judging from other albedos reported for the same lunar age or for ages ± 1 day of the same age. It is too early yet to confirm these suspicions.

Table 6. Sample Monthly Reporting Form for Non-LTP Reports

Date:
Observer:
Location:
Telescope
(kind, aperture, power):
Feature:

Index of Points



Point/Time	U.T	U.T.	U.T.	
A				
B				
C				
D				
E				
Nearby Plain				

Diffraction disk fraction (largest):

Diffraction disk fraction (smallest:

Excursion fraction:

Terminator features:

Field of view (FOV) features:

Altitude of moon:

Time interval between blow-ups:

Time interval between excursions:

It points up the need for several independent measures for each day of lunar age. It is doubtful whether there are any real correlations with any of the hypotheses, although the number of observations of phenomena are too few for significant statistics or conclusions to be drawn. From the few observers who have more or less regularly sent in observations, it has been demonstrated that a catalog or scale of albedos can be set up for each feature from which other observers can then observe the feature, estimate the albedo, and determine whether the feature is normal or phenomenal at that time. Eventually, perhaps, the visual estimates scale can be tied into some of the professional photometric scales or albedos, extending the latter. This would be a contribution to the astronomical profession.

Comparison of albedos of Dawes and Proclus from this program with those of Alphonsus from Vaucher's Selected Areas Program (SAP) program revealed confirmation of some peaks found by Vaucher but not others. These results indicate that the different regions of the moon respond to radiation with varied characteristics.

Acknowledgments

I thank all the observers who have sent in observations, especially those who have reported the information sought in the program. I thank Mr. Bartlett for supplying unpublished observations of Proclus from which albedo and LTP comparisons were made for this report.

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